

What is claimed is:

- 1 1. An apparatus comprising:
2 a cooling plate that encloses an inlet plenum, an outlet plenum, and a
3 plurality of microchannels connecting the inlet plenum to the outlet plenum,
4 wherein the cooling plate is substantially made of silicon.
- 1 2. The apparatus of claim 1, wherein the cooling plate includes
2 a cooling base having the inlet plenum, the outlet plenum, and the plurality
3 of microchannels formed therein, and
4 a cover.
- 1 3. The apparatus of claim 2, wherein the cooling base is made of
2 polycrystalline silicon.
- 1 4. The apparatus of claim 3, wherein the cover is made of polycrystalline
2 silicon.
- 1 5. The apparatus of claim 3, wherein the microchannels are formed by etching
2 into the cooling base.
- 1 6. The apparatus of claim 2, further comprising one or more external fluid
2 connections made at lateral edges of the cooling base.
- 1 7. The apparatus of claim 2, further comprising one or more external fluid
2 connections having openings made through the cover.
- 1 8. The apparatus of claim 2, further comprising an electronics chip having a
2 first face that includes circuitry formed thereon, and a second face that is attached to
3 the cooling base.

1 9. The apparatus of claim 1, further comprising an electronics chip having a
2 first face that includes circuitry formed thereon, and a second face that is attached to
3 the cooling plate.

1 10. The apparatus of claim 9, wherein the chip includes circuitry for at least a
2 portion of a processor, the apparatus further comprising:
3 a memory operatively coupled to the processor;
4 an input/output system, including a display unit, operatively coupled to the
5 processor; and
6 a power supply operatively coupled to the processor.

1 11. The apparatus of claim 9, wherein the chip includes circuitry for at least a
2 portion of a telecommunications circuit, the apparatus further comprising:
3 an antenna operatively coupled to the telecommunications circuit;
4 an input/output system, including a display unit, operatively coupled to the
5 telecommunications circuit; and
6 a power supply operatively coupled to the telecommunications circuit.

1 12. A method for cooling an electronics chip having a substrate with a first face
2 having circuitry thereon, and an opposite second face, the method comprising:
3 providing a cooling plate made of material that matches a coefficient of
4 thermal expansion of the second face of the chip, and that is in thermal contact with
5 the second face of the chip; and
6 moving a cooling fluid through the cooling plate.

1 13. The method of claim 12, wherein the providing of the cooling plate includes
2 providing a polycrystalline silicon substrate;
3 etching into the substrate an inlet plenum, an outlet plenum, and a plurality
4 of microchannels connecting the inlet plenum to the outlet plenum; and

5 attaching a cover to the cooling plate.

1 14. The method of claim 12, wherein the chip is silicon, and wherein the
2 providing of the cooling plate includes
3 providing a polycrystalline silicon substrate;
4 etching into the substrate an inlet plenum, an outlet plenum, and a plurality
5 of microchannels connecting the inlet plenum to the outlet plenum;
6 attaching a cover to the cooling plate; and
7 bonding the silicon chip to the cooling plate.

1 15. The method of claim 12, wherein the moving of the cooling fluid includes
2 pumping the cooling fluid through external fluid connections at lateral edges of the
3 cooling plate.

1 16. An apparatus for cooling an electronics chip having a substrate with a first
2 face having circuitry thereon, and an opposite second face, the apparatus
3 comprising:
4 means for containing a cooling fluid moving through microchannels along
5 the second face inside a layer of silicon located adjacent to the second face.

1 17. The apparatus of claim 16, wherein the means for moving the cooling fluid
2 include an inlet plenum and an outlet plenum in fluid communication with the
3 microchannels, and wherein the microchannels are formed by grooves in a piece of
4 silicon and made separately from the chip.

1 18. The apparatus of claim 16, further comprising:
2 external fluid-connection means for moving the cooling fluid, located at
3 lateral edges of the means for containing the fluid.
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1 19. The apparatus of claim 16, wherein the chip includes circuitry for at least a
2 portion of a processor, the apparatus further comprising:
3 a memory operatively coupled to the processor;
4 an input/output system, including a display unit, operatively coupled to the
5 processor; and
6 a power supply operatively coupled to the processor.

1 20. The apparatus of claim 16, wherein the chip includes circuitry for at least a
2 portion of a telecommunications circuit, the apparatus further comprising:
3 an antenna operatively coupled to the telecommunications circuit;
4 an input/output system, including a display unit, operatively coupled to the
5 telecommunications circuit; and
6 a power supply operatively coupled to the telecommunications circuit.

1 21. The apparatus of claim 16, wherein the microchannels comprise a plurality
2 of parallel high-aspect-ratio grooves etched into a cooling base, wherein the cooling
3 base is covered with a cover.